



# Treatment Technologies For 1,4-Dioxane:

542F07009

## Fundamentals And Field Applications

### FACT SHEET AND ORDER INFORMATION

In December 2006, the U.S. Environmental Protection Agency's (EPA) Office of Superfund Remediation and Technology Innovation (OSRTI) published a report titled, "Treatment Technologies for 1,4-Dioxane: Fundamentals and Field Applications". 1,4-Dioxane (synonym: dioxane) is a synthetic industrial chemical frequently found at contaminated sites where 1,1,1-trichloroethane was used for degreasing. The report provides information about the chemistry of dioxane; cleanup goals; analytical methods; available treatment technologies; and site-specific treatment performance data. This information may be useful to project managers, technology providers, consulting engineers, and members of academia faced with addressing dioxane at cleanup sites or in drinking water supplies. This fact sheet provides a synopsis of the report and ordering information.

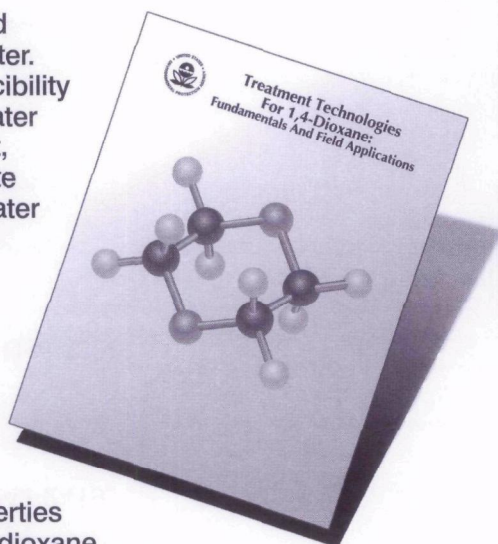
Dioxane is used as a solvent in paints and lacquers and in organic chemical manufacturing. It was used in the past primarily as a stabilizer and corrosion inhibitor in solvents such as 1,1,1-trichloroethane (TCA).

Dioxane is a cyclic ether with a chemical formula of  $C_6H_{10}O$ .

It is hydrophilic and fully miscible in water. Because of its miscibility and low octanol-water partition coefficient, dioxane can migrate farther in groundwater than its associated solvent plume.

In addition, its low Henry's Law constant prevents it from volatilizing from the dissolved to the vapor phase. Such properties make treatment of dioxane in environmental media a challenge.

Groundwater investigations at solvent release sites did not typically include 1,4-dioxane as a target analyte in the past because it was not detectable at low concentrations in a standard laboratory scan for volatile organic compounds. Due to improved analytical methods, however, dioxane is now being detected at lower concentrations than in the past.



EPA and the International Agency for Research on Cancer have classified dioxane as a Group B2 (probable human) carcinogen. However its toxicity is currently being reevaluated. A federal drinking water standard has not yet been established for dioxane. Several EPA regions and states have set screening levels for dioxane based on carcinogenic risk.\* However, even though a legal or regulatory enforcement level is absent in all states except Colorado, dioxane can be subject to regulation through cleanup requirements.

The report covers three technologies that are used to treat dioxane at the pilot and full scale levels: ex situ advanced oxidation process (AOP), carbon adsorption, and bioremediation. Performance data from site-specific applications of each of these technologies are available in the report. A total of 15 projects were identified where dioxane was treated in groundwater.

Twelve of the 15 identified projects used AOPs. In an advanced oxidation process, hydroxyl radicals, which are powerful oxidizers, sequentially oxidize organic contaminants to carbon dioxide, water, and residual chloride. The twelve AOP projects identified in the report used either hydrogen peroxide with ultraviolet light or hydrogen peroxide with ozone.

The report includes information on additional treatment technologies. At one identified site, adsorption using granular activated carbon (GAC) was found to remove dioxane, despite expectations based on the properties of the contaminant. The report also includes information on the use of phytoremediation and bioremediation for dioxane removal.

### Ordering Information

A PDF version of this report is available at <http://clu-in.org/542R06009>.

### Contact

If you have any questions or comments on this fact sheet, please contact Martha Otto, EPA OSRTI, at (703) 603-8853 or [otto.martha@epa.gov](mailto:otto.martha@epa.gov).

\* In September 2004, Colorado became the first state to establish an enforceable standard for dioxane in groundwater and surface water.



# Treatment Technologies For 1,4-Dioxane: Fundamentals And Field Applications

## FACT SHEET AND ORDER INFORMATION

### Order Form

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